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**Kim et al.**

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(54) **LED LIGHTING DEVICE**

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See application file for complete search history.

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CPC ..... **H05B 33/089** (2013.01); **F21K 9/17**  
(2013.01); **H05B 33/0809** (2013.01); **H05B**  
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CPC .. H05B 37/02; H05B 33/08; H05B 33/0809;  
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33/0839; H05B 33/0878

(57) **ABSTRACT**

The present invention provides an LED lighting device, which can be directly connected to a socket for a fluorescent lamp without revising the socket to a dedicated LED Light circuit. The LED lighting device may be prevented from being damaged by the overvoltage generated in the stabilizer and introduced into the driving circuit, and this device is reactivated when a normal voltage is introduced. For this purpose, the LED lighting device includes first and second power input units, first and second rectification units, a smoothing unit, an overvoltage protection unit, and a driving voltage generation unit.

**2 Claims, 2 Drawing Sheets**

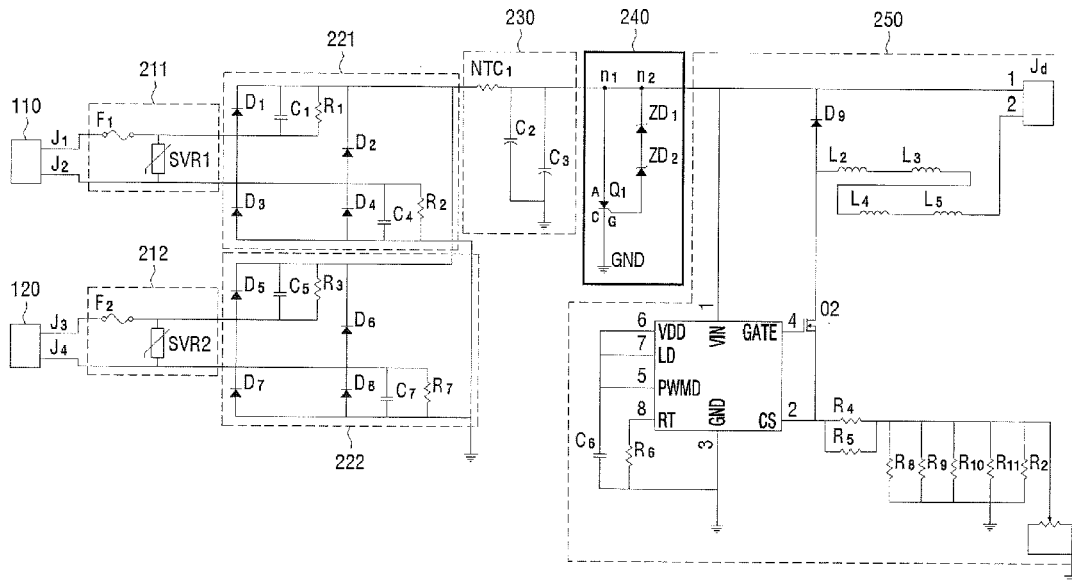


FIG. 1

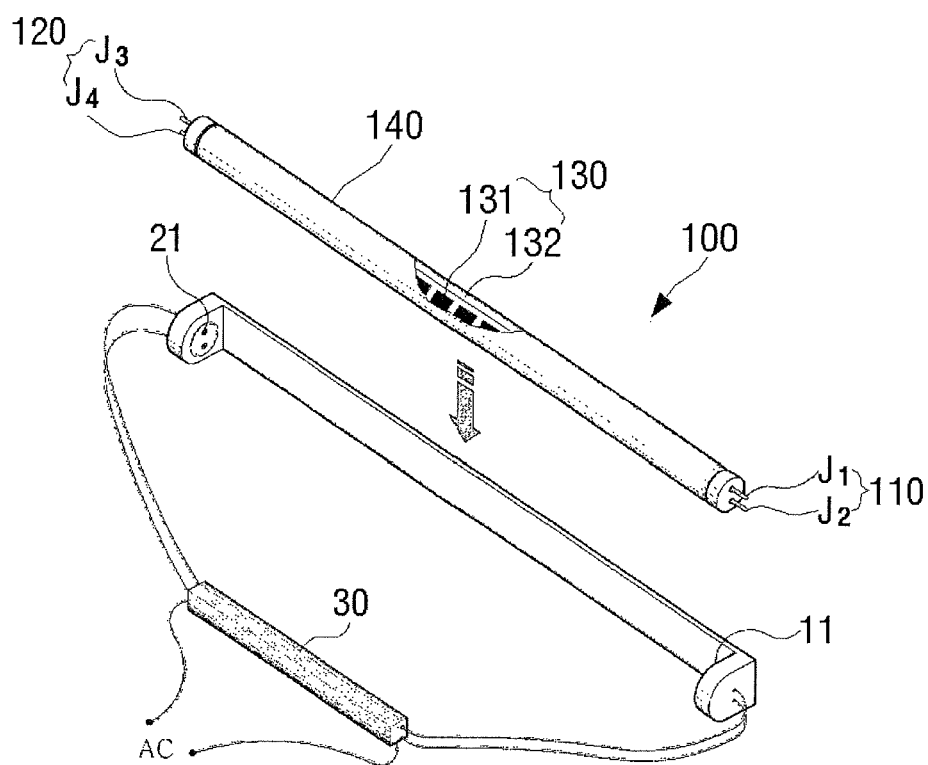
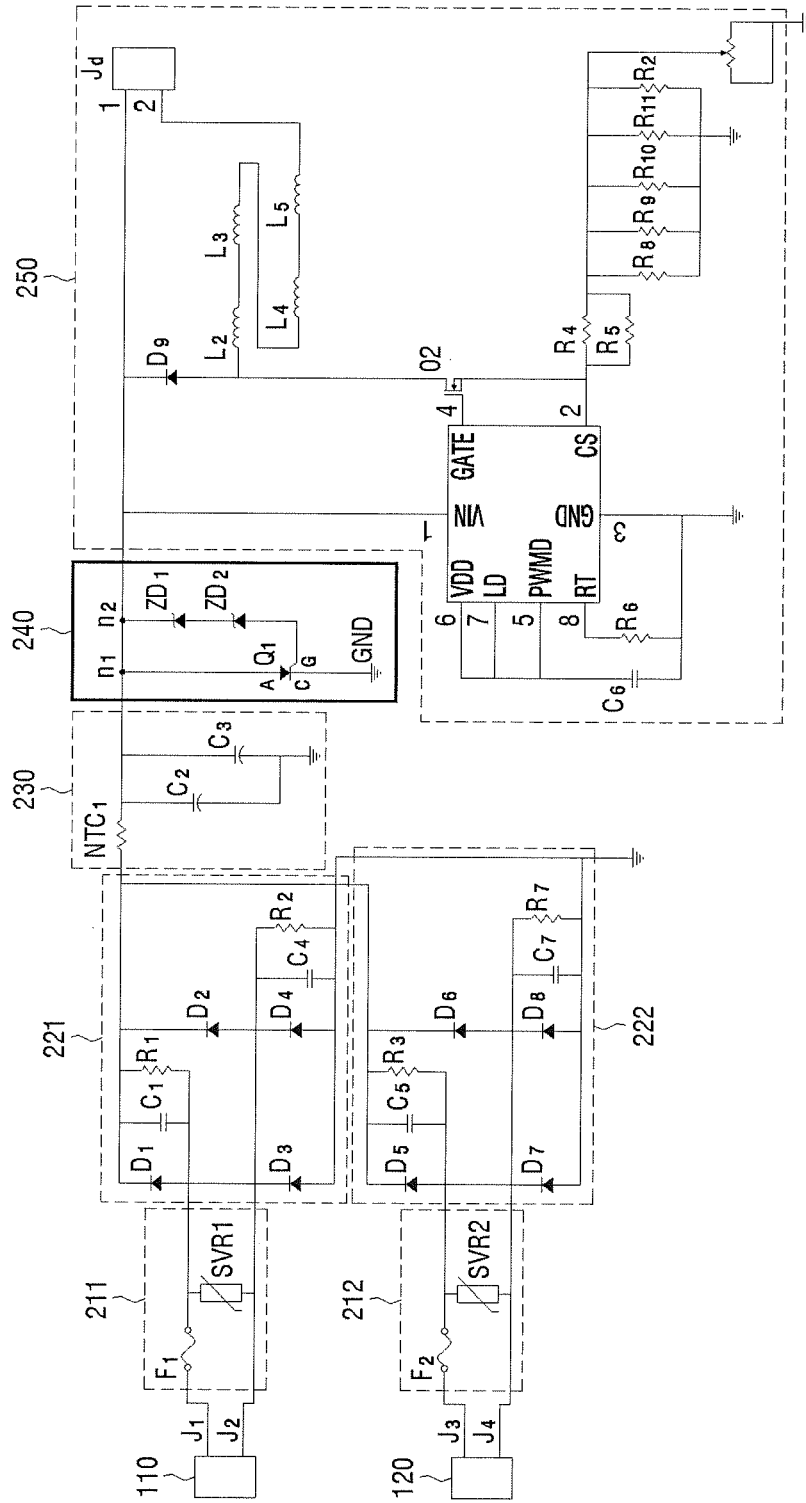


FIG. 2



## LED LIGHTING DEVICE

## BACKGROUND OF THE INVENTION

## 1. Field of the Invention

The present invention relates to an LED lighting device, and more particularly, to an LED lighting device that is capable of being directly connected to a socket for a fluorescent lamp to prevent an electric circuit from being damaged even though an overvoltage of stabilizer is introduced while using power supplied from the stabilizer.

## 2. Description of the Related Art

A fluorescent lamp is a lighting mechanism using visible light that is generated by sealing a discharging gas in a glass tube having an inner wall coated with a fluorescence material to allow ultraviolet light, which is generated by discharging the discharging gas, to collide with the fluorescence material. The fluorescent lamp requires relatively low power consumption and has a relatively long lifecycle when compared to those of a filament lamp used for an initial lighting mechanism. Thus, the fluorescent lamp is being used as a primary lighting device for a long time. However, the fluorescent lamp has an environmental problem in which mercury is generated when the fluorescent lamp is wasted. Thus, the fluorescent lamp is restrained in use.

Also, since a lighting device using a light emitting diode (LED) is more effective in energy saving than the fluorescent lamp and has a long lifecycle, the lighting device using LED is being spotlighted in recent years.

Although the LED lighting device has various advantages as described above, the fluorescent lamp may not be replaced with the LED lighting device because the LED lighting device does not use a typical socket connected to the fluorescent lamp due to a difference in driving manner between the fluorescent lamp and the LED. That is, the LED lighting device includes a driving circuit converting a commercial AC power applied to the fluorescent lamp to a rated DC power for operating the LED.

To solve these problems, many technologies on the LED lighting device connected to the socket for the fluorescent lamp in a state where the stabilizer is not removed are being suggested.

However, in the LED lighting device connected to the typical socket for the fluorescent lamp, only an electric circuit for simply converting an AC power into a DC power for driving the LED is disclosed.

Thus, the LED lighting device connected to the typical socket for the fluorescent lamp is inadequate in countermeasure with respect to a problem that occurs when an overvoltage generated by momentary discharge in the stabilizer is applied from the socket.

Also, it is suggested that the LED lighting device connected to the socket for the fluorescent lamp, which is disclosed in the related art so as to block the overvoltage, has a structure in which the electric circuit is broken by using a fuse and a varistor when the overvoltage is introduced as a countermeasure with respect to the overvoltage generated from the stabilizer. However, according to this method, since the circuit is in an inoperable state due to the complete cutting of the fuse, the circuit may not operate any more even though a normal voltage is applied later.

## SUMMARY OF THE INVENTION

## Technical Problem

Exemplary embodiments of the present invention overcome the above disadvantages and other disadvantages not

described above. Also, the present invention is not required to overcome the disadvantages described above, and an exemplary embodiment of the present invention may not overcome any of the problems described above.

Accordingly, the present invention provides an LED lighting device that is directly connected to a socket for a fluorescent lamp to prevent a circuit from being damaged when an overvoltage occurs.

The present invention also provides an LED lighting device that is capable of blocking only a flow of current with respect to the overvoltage, before the circuit is damaged to become in an inoperable state, to protect the circuit.

## Technical Solution

To solve the above-described problems, an LED lighting device may include: first and second power input units receiving an AC voltage generated in a stabilizer for a fluorescent lamp, the first and second power input units being broken when an overvoltage or overcurrent is introduced; first and second rectification units wave-rectifying an AC power outputted from the first and second power input units; a smoothing unit smoothing a wave-rectification outputted from the first and second rectification units; an overvoltage protection unit blocking a flow of current when a voltage outputted from the smoothing unit is an overvoltage that is equal to or greater than a critical value, the overvoltage protection unit including first and second Zener diodes reversely connected to an output terminal of the smoothing unit and a silicon rectification controller, wherein the silicon rectification controller serves as a switch device which guides a flow of current to a cathode connected to a ground point from an anode connected to an output terminal of the smoothing unit when the first and second Zener diodes are conducted to each other, and current flowing through the second Zener diode is introduced to the gate; and a driving voltage generation unit generating a driving voltage for driving a plurality of diodes on the basis of a DC voltage outputted from the overvoltage protection unit.

The sum of Zener voltages of the first and second Zener diodes may be a DC voltage ranging from about 300 V to about 350 V.

## Advantageous Effects

In the LED lighting device according to the present invention, the driving circuit may be prevented from being damaged by the overvoltage generated in the stabilizer and introduced into the driving circuit to maintain the stable operation of the driving circuit.

Also, in the LED lighting device according to the present invention, a flow of the overvoltage is blocked before the fuse is damaged and the overvoltage is discharged to the ground, so that the driving circuit is stopped without damaging the driving circuit.

Accordingly, in the LED lighting device according to the present invention, an operation of the driving circuit is restricted when an unstable overvoltage is introduced and the circuit is reactivated when a normal voltage is introduced.

## BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

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FIG. 1 is a perspective view of an LED lighting device according to the present invention; and

FIG. 2 is a circuit diagram illustrating a driving circuit of the LED lighting device according to the present invention.

#### DESCRIPTION OF THE REFERENCE SYMBOLS

**11, 12:** socket for a fluorescence lamp, **30:** stabilizer, **100** LED lighting device, **110, 120:** first and second input terminals, **130:** LED module, **131:** LED, **132:** printed circuit board, **140:** tube

#### DETAILED DESCRIPTION OF THE EMBODIMENTS

Hereinafter, embodiments of the present invention will be described with reference to the accompanying drawings to realize the above-described objects. Like reference numerals refer to like elements throughout, and an additional description for this is not provided.

FIG. 1 is a view of an LED lighting device using an electronic stabilizer as an LED lighting device according to the present invention. Although the LED lighting device according to the present invention is applied to both an electronic stabilizer and a magnetic stabilizer, the LED lighting device connected to a socket for a fluorescent lamp using the electronic stabilizer illustrated in the drawings will be described in this specification.

Referring to FIG. 1, an LED lighting device **100** according to the present invention includes an LED module **130**, a tube **140**, first and second input terminals **110** and **120**, and a driving circuit (now shown).

The LED module **130** includes an LED **131** and a printed circuit board **132** on which an electric wire providing a driving voltage to the LED **131** is formed.

The tube **140** has a cylindrical shape surrounding the LED module **130** to protect the LED module and diffuses light emitted from the LED **131**. The tube may be formed of polycarbonate.

First and second input terminals **110** and **120** are connected to sockets **11** and **21** for a fluorescent lamp to receive a power. Each of the first and second input terminals **110** and **120** has the form of an electrode exposed from a cap surrounding both ends of the tube **140**. That is, the first input terminal **110** includes first and second electrodes **J1** and **J2** connected to the first socket **11**, and the second input terminal **120** includes third and fourth electrodes connected to the second socket **21**.

The driving circuit converts a high frequency AC power of the stabilizer **30**, which is provided through the first and second input terminals **110** and **120**, into a rated DC voltage for operating the LED to output the converted voltage. Particularly, when the power generated in the stabilizer **30** is an overvoltage that is equal to or greater than a critical value, the driving circuit may be broken to protect a driving voltage generation unit.

As illustrated in the circuit view of FIG. 2, driving circuit includes first and second power input units **211** and **212**, first and second rectification units **221** and **222**, a smoothing unit **230**, an overvoltage protection unit **240**, and a driving voltage generation unit **250**.

The first power input unit **211** receives an AC power through the first input terminal **110** and includes a first fuse **F1** connected in series to the first electrode **J1** and a first varistor **SVR1** connected in parallel to the first and second electrodes **J1** and **J2**. The first fuse **F1** and the first varistor

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**SVR2** breaks a circuit disposed at a rear side thereof when an overvoltage or overcurrent is introduced to protect the circuit.

Similarly, the second power input unit **212** receives an AC power through the second input terminal **120** and includes a second fuse **F2** connected in series to the third electrode **J3** and a second varistor **SVR2** connected in parallel to the third and fourth electrodes **J1** and **J2**.

The first and second rectification units **221** and **222** wave-rectifies an AC power introduced through each of the first and second power input units **211** and **212**.

That is, the first and second rectification units **221** and **222** wave-rectify the AC power introduced through the first electrode **J1** and the second electrode **J2**, the third electrode **J3** and the fourth electrode **J4**, the first electrode **J1** and the third electrode **J3**, the first electrode **J1** and the fourth electrode **J4**, the second electrode **J2** and the third electrode **J3**, or the second electrode **J2** and the fourth electrode **J4**.

For this, the first and second rectification units **221** and **222** may be connected to first to fourth diodes **D1**, **D2**, **D3**, and **D4** and fifth to eighth diodes **D5**, **D6**, **D7**, and **D8** in a bridge shape, respectively. Here, the first to fourth diodes **D1**, **D2**, **D3**, and **D4** and the fifth to eighth diodes **D5**, **D6**, **D7**, and **D8** may have the same bridge structure with respect to each of the first and second input units **211** and **212**.

Also, the first and second rectification units **221** and **222** include first and fourth capacitors **C1** and **C4** and fifth and seventh capacitors **C5** and **C7** for removing a noise.

The smoothing unit **230** removes ruffle of the AC power that is wave-rectified by the first and second rectification units **221** and **222** to smooth the AC power. For this, the smoothing unit **230** includes a negative temperature coefficient (NTC) thermistor **NTC1** connected to an output terminal of the first and second rectification units **221** and **222** and second and third capacitors connected in parallel to the NTC thermistor **NTC1**.

When a voltage outputted from the smoothing unit **230** is equal to or greater than a critical overvoltage, the overvoltage protection unit **240** prevents the driving voltage generation unit **250** from being damaged by the overvoltage introduced into the driving voltage generation unit **250**.

For this, the overvoltage protection unit **240** includes first and second Zener diodes **ZD1** and **ZD2** reversely connected to an output terminal **n1** of the smoothing unit **230** and a switching device **Q1**.

The switching device **Q1** uses a silicon controlled rectifier (hereinafter, refers to as SCR). An anode **A** of the switching device **Q1** is connected to the first node **n1** that is an output terminal of the smoothing unit **230** and a cathode **C** is connected to the ground **GND**. Also, a gate **G** of the switching device **Q1** is connected to an anode of the second Zener diode **ZD2**.

The first Zener diode **ZD1** includes a cathode reversely connected between the output terminal **n1** of the smoothing unit **230** and the input terminal of the driving voltage generation unit **250**, and the second Zener diode **ZD2** is connected in series to the first Zener diode **ZD1**. Accordingly, the first and second Zener diodes **ZD1** and **ZD2** may be conducted to the output terminal **n1** of the smoothing unit **230** when a voltage equivalent to the sum of Zener voltages of the first and second Zener diodes **ZD1** and **ZD2** flows.

Also, the anode of the second Zener diode **ZD2** is connected to the gate **G** of the switching device **Q1**. That is, when the first and second Zener diodes **ZD1** and **ZD2** are conducted to each other, a voltage outputted from the second Zener diode functions as an operation voltage of the switching device **Q1**.

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An operation of the overvoltage protection unit **240** constituted by the above-described circuits will be described below.

When a voltage outputted from the smoothing unit **230**, which is less than a Zener voltage, is applied, the output terminal of the overvoltage protection unit **240** has the same potential as that of the input terminal to provide the power applied from the input terminal to the driving power generation unit **250**. That is, current does not flow through the overvoltage protection unit **240** connected to the output terminal n1 of the smoothing unit **230**.

Also, the first and second Zener diodes ZD1 and ZD2 may be conducted to each other when a voltage outputted from the smoothing unit **230** is equal to or greater than the sum of Zener voltages of the first and second Zener diodes ZD1 and ZD2.

Thus, when current is introduced to the gate of the switching device Q1 via the second Zener diode ZD2, the current flows from the anode A to cathode C of the switching device Q1.

That is, while the current flows from the output terminal n1 of the smoothing unit **230** to the ground GND, the current flowing from the smoothing unit **230** to the driving voltage generation unit **250** is blocked.

The above-described circuit may be set so that the first and second Zener diodes ZD1 and ZD2 have the sum of the Zener voltages, which is less than the voltage blocked by the power input unit **211** and **212**. For example, each of the first and second Zener diodes ZD1 and ZD2 has a Zener voltage of about 150 V. That is, the overvoltage protection unit **240** may be set to break the circuit when the output voltage outputted from the smoothing unit **230** is equal to or greater than about 300V.

The driving voltage generation unit **250** generates a driving voltage for driving a plurality of LEDs from a DC voltage outputted from the overvoltage protection unit **240** to provide the driving voltage to the LED through an LED connection electrode.

The driving circuit generation unit **250** generates a driving voltage corresponding to the sum of a forward voltage that is required by the plurality of LEDs connected in series or parallel to each other. That is, the voltage required for operating the LED may be outputted regardless of the intensity of the voltage and current introduced from the overvoltage protection unit **240**. As a result, although voltages provided from the overvoltage protection unit **240** are different from each other, an additional tuning process according to a required voltage of the LED lighting device is not required because the voltage outputted from the LED connection electrode Jd is uniform.

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For this operation, the driving voltage generation unit **250** may use a DC-DC converter using a pulse width modulation (PWM) control method as illustrated in the drawings. Alternatively, the driving voltage generation unit **250** may use a pulse frequency modulation control method (PFM) changing a period of a clock having a fixed pulse width to maintain the output voltage or a variable frequency modulation control method controlling a clock outputted with a fixed pulse according to an output voltage error to maintain the output voltage.

Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. An LED lighting device, comprising:

- first and second power input units receiving an AC voltage generated in a stabilizer for a fluorescent lamp, the first and second power input units being broken when an overvoltage or overcurrent is introduced;
- first and second rectification units wave-rectifying an AC power outputted from the first and second power input units;
- a smoothing unit smoothing a wave-rectification outputted from the first and second rectification units;
- an overvoltage protection unit blocking a flow of current when a voltage outputted from the smoothing unit is an overvoltage that is equal to or greater than a critical value, the overvoltage protection unit comprising first and second Zener diodes reversely connected to an output terminal of the smoothing unit and a silicon rectification controller, wherein the silicon rectification controller serves as a switch device which guides a flow of current to a cathode connected to a ground point from an anode connected to an output terminal of the smoothing unit when the first and second Zener diodes are conducted to each other, and current flowing through the second Zener diode is introduced to the gate; and
- a driving voltage generation unit generating a driving voltage for driving a plurality of diodes on the basis of a DC voltage outputted from the overvoltage protection unit.

2. The LED lighting device of claim 1, wherein the sum of Zener voltages of the first and second Zener diodes is a DC voltage ranging from about 300 V to about 350 V.3.

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